CORONA DIVISION
NAVAL SURFACE WARFARE CENTER

CORONA

IUID Center

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MAKING SEA POWER 21 A REALITY

NSWC Corona IUID Center

Implementation Assistance

Consumer Reports

IUID Community

Innovation

Training

Our mission is to provide expertise in mission-focused lifecycle management through IUID integration.

Aspects of IUID

Political

Policies
Scope
Timelines & implementation dates

Technical

What is IUID
Marking parts
Reading & verifying the marks
IT infrastructure

Value

Serialized Item Management (SIM)
Machine readable marks
Tamper-resistant marks
(counterfeits, reserialization, ECC200)
Reconciliation of separate databases

Implementation

IUID is Like a Snowflake

DoD Moves Boldly Into AIT

29 July 2003: DoD establishes policy requiring Item Unique Identification (IUID) using 2-D Data Matrix barcodes

2 October 2003: DoD establishes policy requiring Radio Frequency Identification (RFID)

[AIT] will enable hands-off processing of materiel transactions, allowing the DoD to re-apportion critical manpower resources to warfighting functions and to streamline business processes."

Why?

Data is Essential, Data Could Be Cheaper

Data Is Not Cheap

This is not the problem any longer

1)Data Capture

Machine readable marks

2) Data Storage

-media

-

safeguardin

g

-retrieval

Data accuracy leads to

- Less data scrubbing
- More fidelity in analysis

3) Data Analysis

UID makes Data Cheaper

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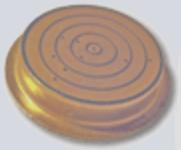
The Devil is in the Details

Automatic Identification Technology (AIT)

1-D Barcode

1D Barcode

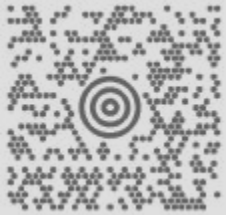
Contact Memory Buttons



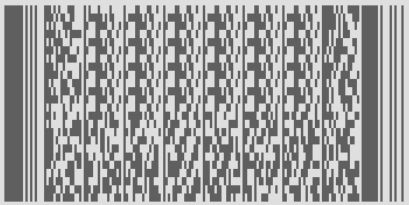
2-D Barcodes

Data Matrix

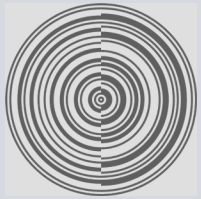
QR Code



MaxiCode



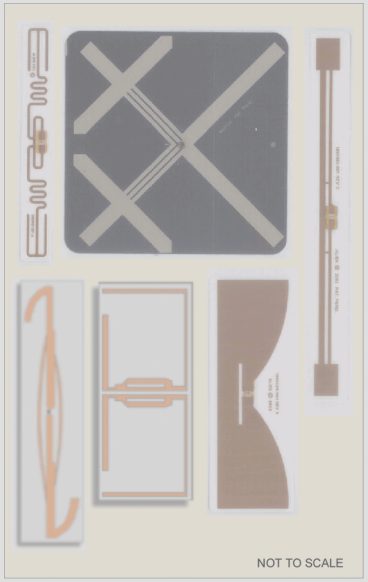
PDF417



Bullseye

Aztec

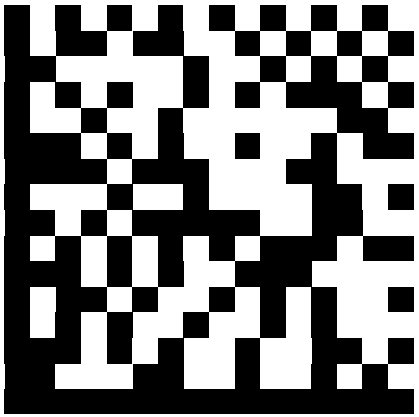
Passive RFID Tags



EPC RFID Tag

Active RFID Tags

Why the Data Matrix?



Scalable

for marking small parts

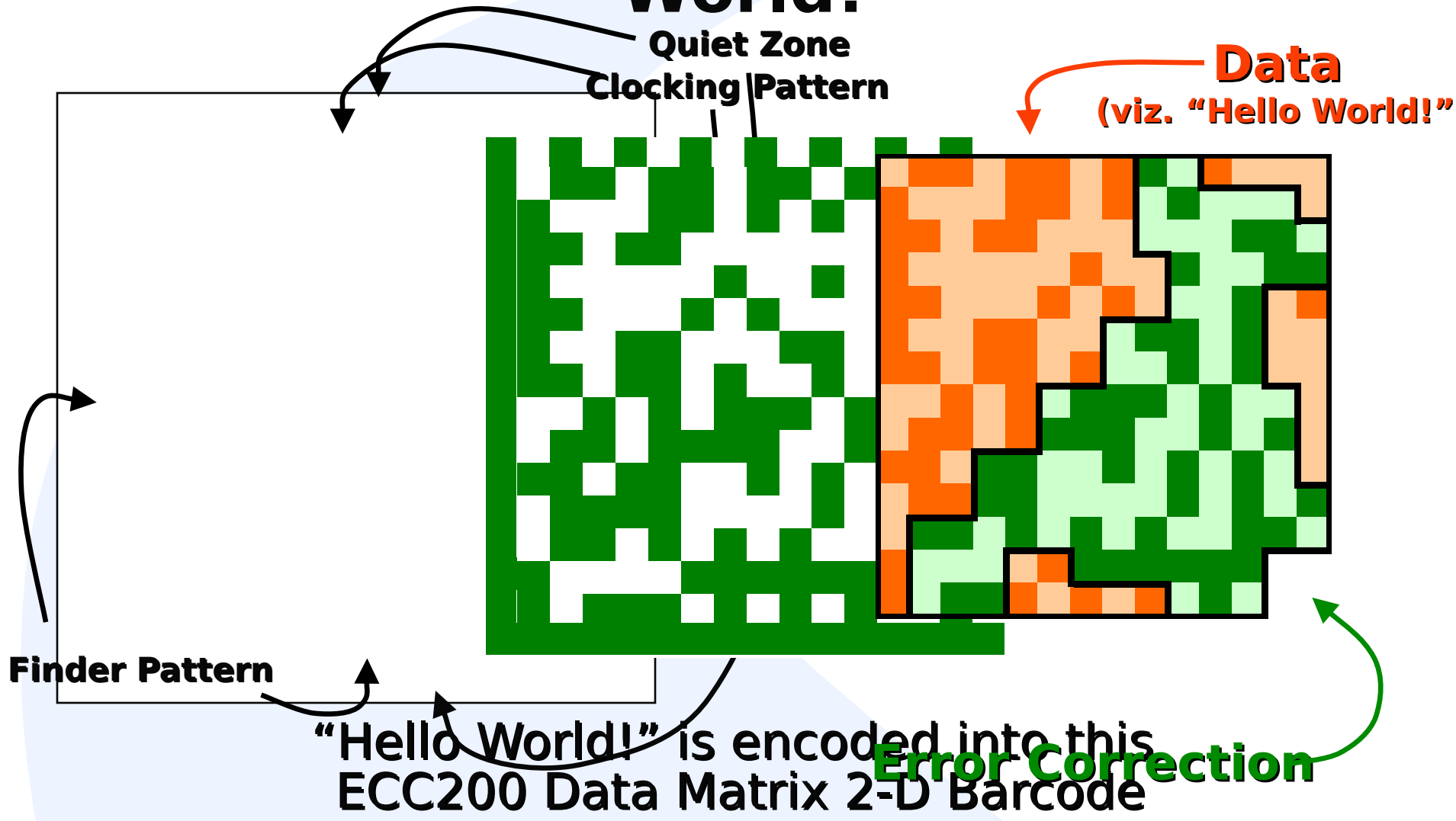
Capacity:

Up to 2,335 alphanumeric characters

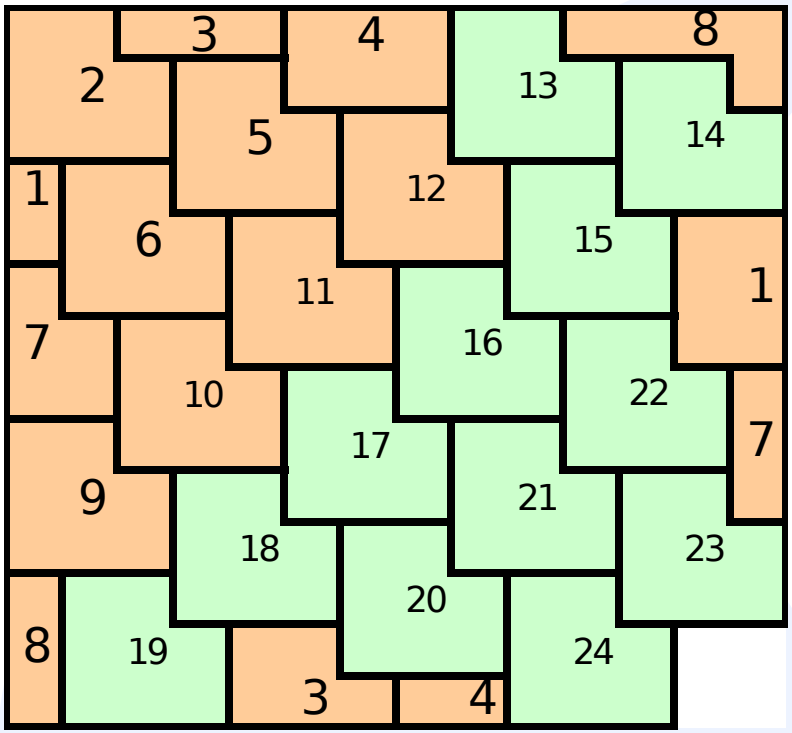
Multiple ways to make your mark

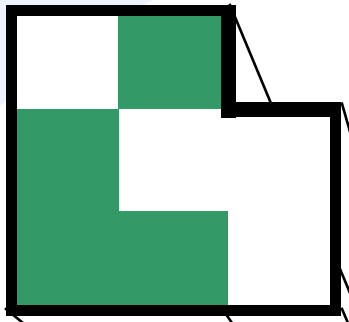
Error Correction: ~50%

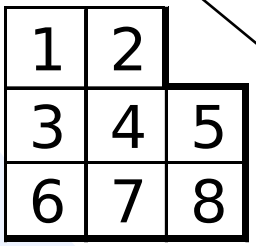
Hello World!


Quiet Zone
Clocking Pattern
Data
(viz. “Hello World!”)
Finder Pattern
“Hello World!” is encoded into this ECC200 Data Matrix 2-D Barcode
Error Correction

Data Matrix Map



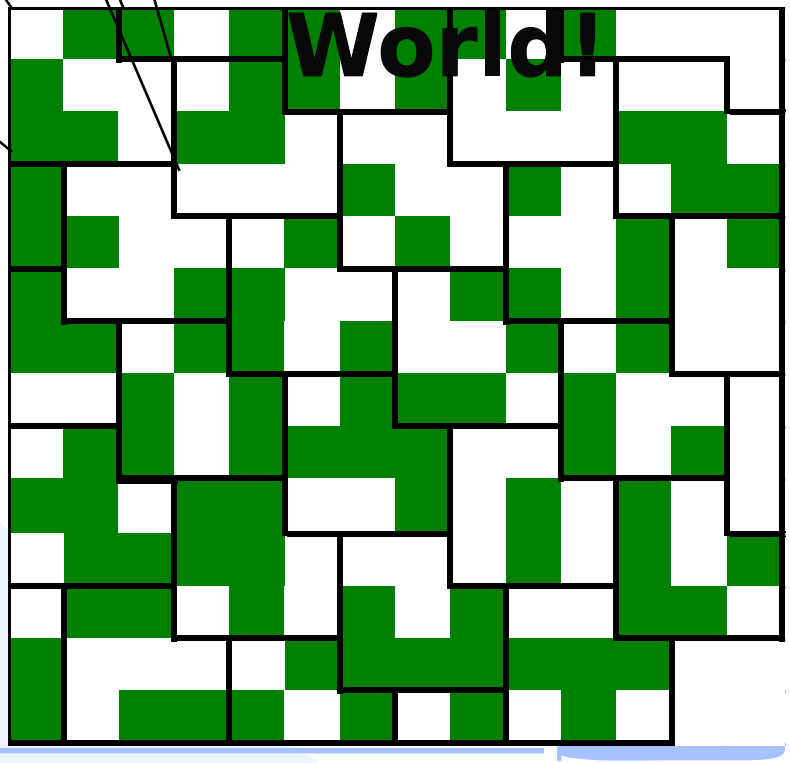




01100110 = 102

ASCII → “e”

Hello World!



A 16 x 16 Data Matrix holds

12 bytes with the data

&

12 error-correcting bytes

But 102 isn't an "e"

The data itself goes through a layer of encoding prior to the symbol

For "ASCII Encoding," characters 0-127 have 1 added, 101 + 1 = 102

is extra complication provides different optimization

ASCII – Digits optimized
2 : 1,
C40 – Uppercase letters optimized
3 : 2,
TEXT – Lowercase letters optimized
3 : 2,

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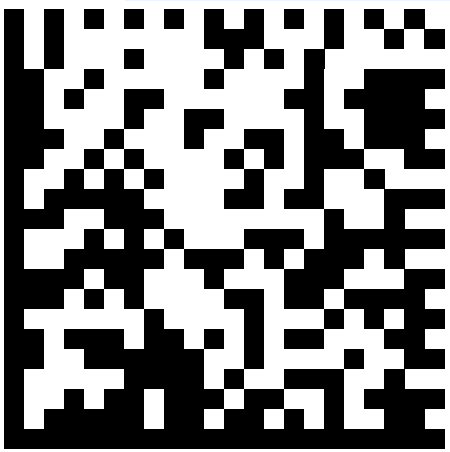
Excel Demo

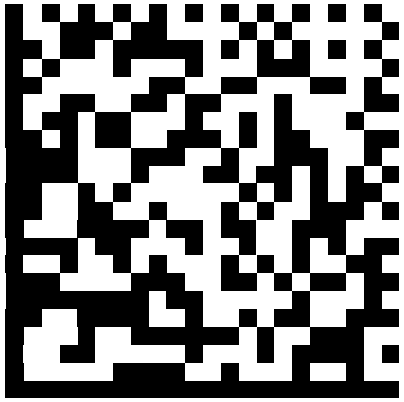
Can You Spot the IUID?



Both are a Data Matrix, but only one is an IUID

An IUID is always a Data Matrix
A Data Matrix is <u>not</u> always an IUID

Turning a Data Matrix into an IUID



The right information encoded into the right kind of mark

Semantics

[)>RS06GS17V98345GS1PT123GSS531RSEOT

Format Code:

Data Identifiers:

Enterprise Identifier:

Part Number:

Serial Number:

Unique Item Identifier (UII) : D98345T123531

IUID Data Constraints

Must be encoded into an ECC200 Data Matrix 2-D barcode

Must include semantics from ISO/IEC 15434

UII ≤ 50 characters

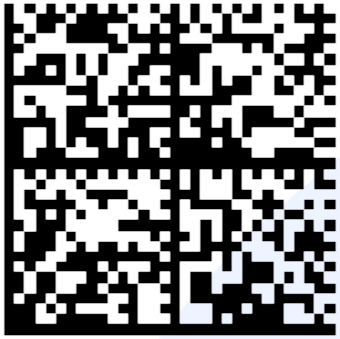
A through Z 0 through 9 / -

no lower case letters, periods, asterisks, …

The UII must be unique across DoD

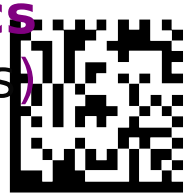
The UII must be “permanent”

IUID Constraint Examples



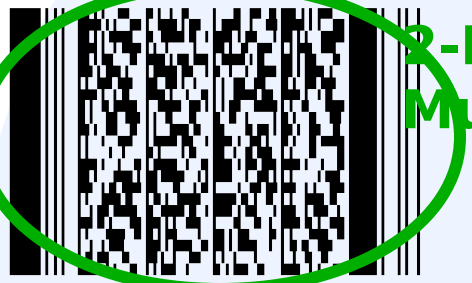
UII too long
50 characters max!

No Semantics
(i.e. [)>, r/s, g/s, eot, DIs)



D23473QT128AQ153

LDN624267OSC1234672-CABLE/COAX293-18L58P9S21GGM93285



2-D barcode is a PDF417
Must be an ECC200 Data Matrix

D23473WFH-1234563548A

D23473KFH-128456LP-3908

Duplication

D23473WFH-1234563548A

D908344-203,3-2784a983451

Uses forbidden characters

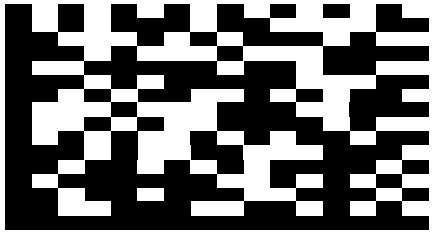
Marking Techniques

- Labels (Stickers)
- Data Plates
- Dot Peen
- Laser Etch
- Chemical Etch
- Silk Screening
- Thermal
- Ink Jet Printing
- Laser Ablation
- Laser "Annealing"
- Cast/Forged
- Laser Bonding
- Embroidery
- Photo Etch

Compliant UII marks are optically read…so almost any marking

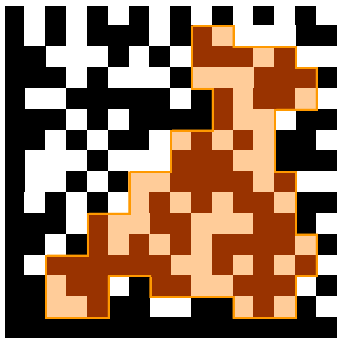
Verification

he symbol shall have a minimum print quality of 3.0/05/660, ...”
Sayeth MIL-STD-130

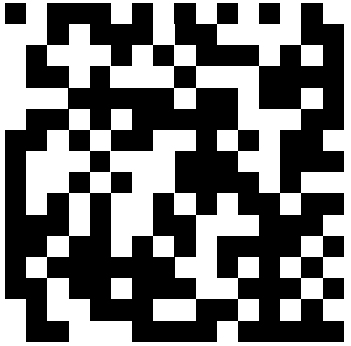


Axial Non-uniformity

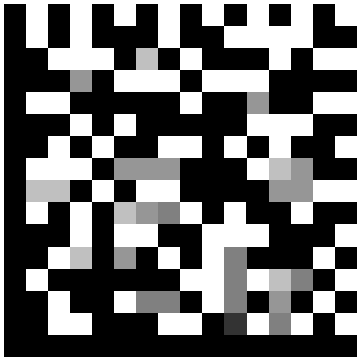
Grid Non-uniformity



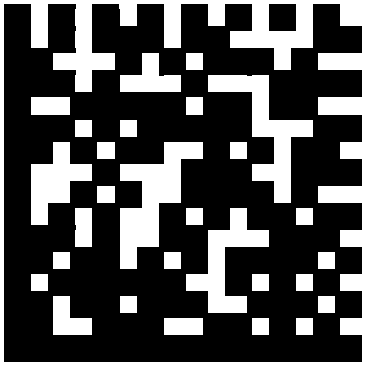
Unused Error Correction



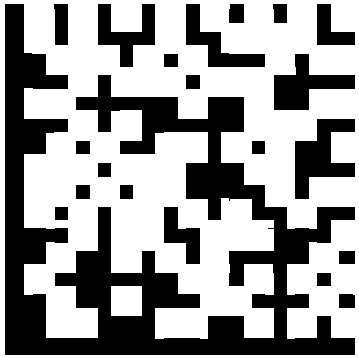
Fixed Pattern Damage



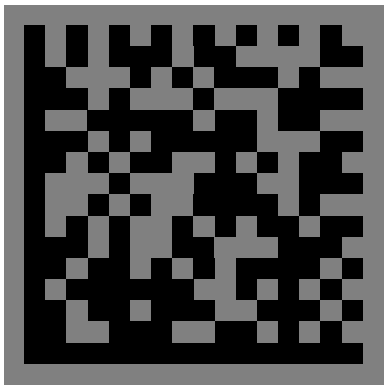
Modulation



Over-print



Under-print



Contrast

A Readable, Failing Mark

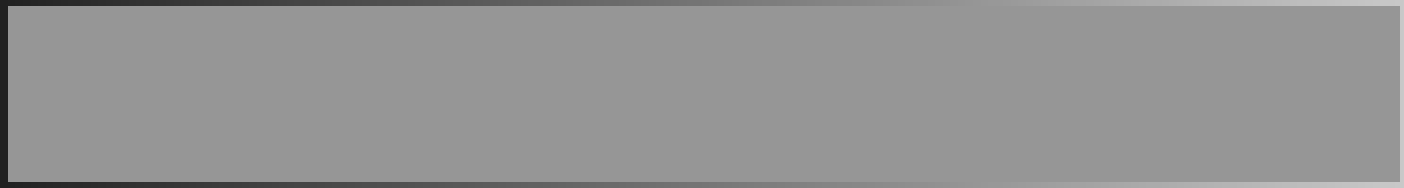
UNDER PRINT

OVER PRINT

CLOCKING PATTERN DAMAGE

FINDER PATTERN DAMAGE

The Simultaneous Contrast Illusion



Most problems within a mark are undetectable with the human eye!

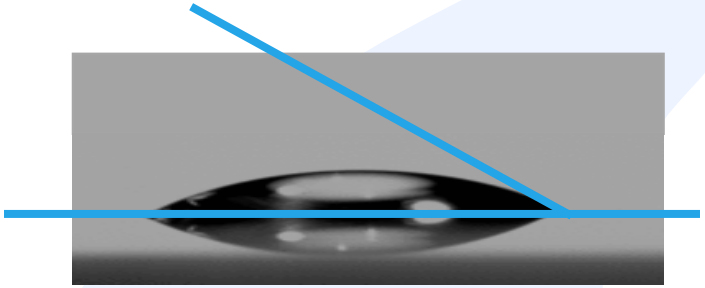
Labels 101

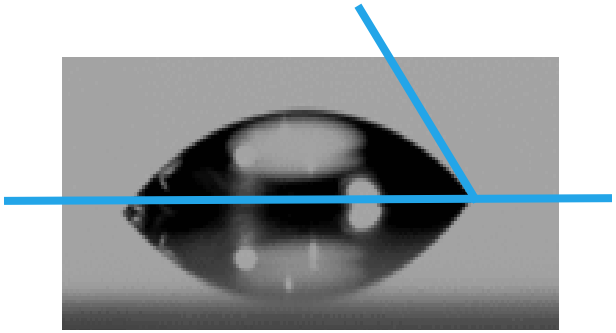
Labels…

+ Are the cheapest option
+ Work for a majority of situations
+ Produce high contrast marks
+ Have low impact when “goofed up”
+ Can show quick progress toward compliance

- Are destroyed by temperature extremes
- Can fall off/be removed
- Are soft (abrasion problems)
- Can out-gas
- Are vulnerable to certain chemicals & UV light

Will the Label Stick?





High Surface Energy

"sticky"

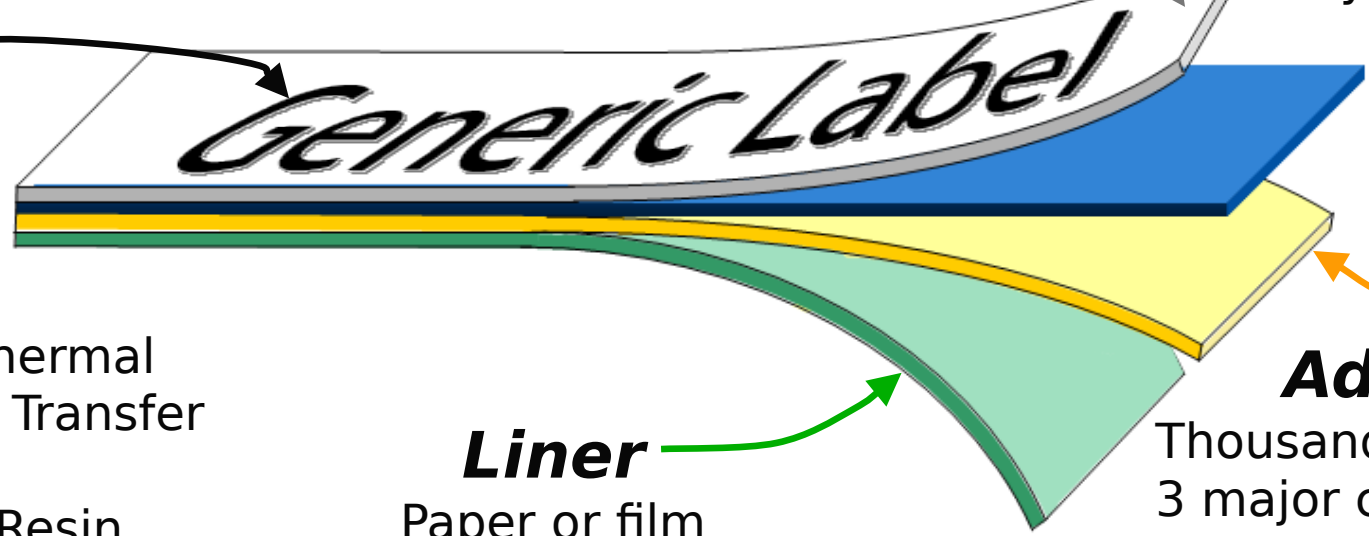
Low Surface Energy

Not so "sticky"

Surface	Surface Energy (mJ/m²)
Copper	1103
Aluminum	840
Zinc	753
Tin	526
Lead	458
Stainless Steel	700-1000
Glass Porcelain	250-500
Kapton	50
Phenolic	47
Nylon	46
Alkyd Enamel	45
Polyester	43
Epoxy Paint	43
Polyurethane Paint	43
ABS	42
Polycarbonate	42
Rigid PVC	39
Noryl Resin	38
Acrylic	38
PVA	37
Polystyrene	36
Acetal	36
EVA	33
Polyethylene	31
Polypropylene	29
Tedlar	28
Teflon	18
Powder Coated Paint	Varies

Data from 3M Corporation

Anatomy of a Label



Top Coat

Optional layer
Added by the manufacturer,
Can help overcome:
UV, chemicals, abrasion problems

Face Stock

Paper
Polypropylene
Polyester
Polyolefin

"Ink"

Inkjet
Toner
Direct Thermal
Thermal Transfer
- Wax
- Wax/Resin
- Resin

Direct Laser

Liner

Paper or film
Moisture stability important to minimize edge curl
Comes with release coating

Adhesive

Thousands of choices!
3 major categories
- Rubber PSA
- Acrylic PSA
- Silicone PSA

Label Tips

- **Prepare the application surface**
  - Use 50% water, 50% isopropyl alcohol
  - Don’t use Windex (shine factors are added)
  - Don’t use denatured alcohol
  - Don’t use acetone as a last step
  - Avoid contaminating surface with skin oils
- **Bag your supplies (polypropylene bags)**
- **Temperature at application ≥ 55º F**
- **Application pressure**

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QUESTIONS & ANSWERS

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IUID Community ■ Innovation ■ Training